

## CLAIMS

What is claimed is:

1. A radio frequency (RF) amplifier system comprising:  
an RF power amplifier having an input and an output;  
an adaptive feedback channel coupled between the input and the output of the RF power amplifier, the adaptive feedback channel receiving as inputs audio signals for modulation of the input of the RF power amplifier, a frequency command word indicative of a desired frequency and phase of the RF amplifier system, and a control word indicative of a desired power level of the output of the RF power amplifier and of a mode of operation of the RF amplifier system, wherein in response to the inputs the adaptive feedback channel provides as an output a degenerative feedback signal to the input of the RF power amplifier.

2. The RF amplifier system of claim 1, wherein the adaptive feedback channel comprises:  
control and reference module circuitry which receives as inputs the audio signals for modulation of the input of the RF power amplifier, the frequency command word indicative of a desired frequency and phase of the RF amplifier system, and the control word indicative of a desired power level of the output of the RF power amplifier and of the mode of operation of the RF amplifier system, the control and reference module circuitry providing as outputs a control information data word to control the desired output power level of the RF power amplifier, and a frequency command word indicative of the desired frequency and phase of the RF power amplifier output;

a high dynamic range receiver coupled to the output of the RF power amplifier and receiving a sample of the output as an input, the high dynamic range receiver also receiving as an input the frequency command word from the control and reference module circuitry, the high dynamic range receiver comparing the sample of the output to phase and frequency information contained in the frequency command word and

determining any phase error, the high dynamic range receiver providing as an output a phase adjustment signal as a function of the phase error;

a phase and amplitude controller coupled to the control and reference module, to the high dynamic range receiver and to the output of the RF power amplifier, the phase and amplitude controller receiving as inputs the control information data word from the control and reference module, the phase adjustment signal from the high dynamic range receiver, and the sample of the output of the RF power amplifier, the phase and amplitude controller generating in response the degenerative feedback signal to control the phase and amplitude of the output of the RF power amplifier.

3. The RF amplifier system of claim 2, wherein the control and reference module circuitry also receives as an input forward and reflected power signals which are respectively indicative of power of signals transmitted by the output of the RF power amplifier and power of signals reflected back to the output of the RF power amplifier, the control and reference module circuitry generating the a control information data word to control the desired output power level of the RF power amplifier also as a function of the forward and reflected power signals.

4. The RF amplifier system of claim 3, wherein the control and reference module circuitry generates the control information data word also as a function of a desired mode of operation of the RF amplifier system, and wherein the phase and amplitude controller generates the degenerative feedback signal as a function of the desired mode of operation.

5. The RF amplifier system of claim 4, wherein the control and reference module circuitry generates the control information data word as a function of audio signals when the desired mode of operation of the RF amplifier system is an amplitude modulation mode of operation, and wherein the phase and amplitude controller generates the degenerative feedback signal such that the input to the RF power amplifier is amplitude modulated by the audio signals.

6. The RF amplifier system of claim 5, wherein the RF power amplifier input includes a first coupler which receives an RF input signal and the degenerative feedback signal as inputs, and provides as a coupler output a modulated RF input signal.

7. The RF amplifier system of claim 3, wherein the high dynamic range receiver generates the phase adjustment signal to maintain a phase change between the input and output of the RF power amplifier of 180 degrees.

8. The RF amplifier system of claim 7, wherein the RF power amplifier includes at least one high gain amplification stage coupled to the input and at least one high power driver stage coupled to the output.

9. The RF amplifier system of claim 8, wherein the output of the RF power amplifier includes a directional coupler coupled to the high power driver stage, and wherein the directional coupler provides as outputs an RF output signal and the input forward and reflected power signals.

10. The RF amplifier system of claim 9, wherein the RF power amplifier further includes:

a second coupler coupling the high power driver stage to the directional coupler;  
and

a tap coupled between the second coupler and the directional coupler, the tap providing the sample of the output to the high dynamic range receiver and the phase and amplitude controller.

11. The RF amplifier system of claim 1, wherein the RF power amplifier provides a gain of at least 30 between the input and the output.

12. The RF amplifier system of claim 1, wherein the RF power amplifier provides a gain of at least 100 between the input and the output.

13. The RF power amplifier system of claim 1, wherein the RF power amplifier provides a gain of at least 1000 between the input and the output.

14. An RF amplifier system comprising:  
an RF power amplifier having an input and an output;  
adaptive feedback channel means coupled between the input and the output of the RF power amplifier for providing a degenerative feedback signal to the input of the RF power amplifier.